

LA-UR-18-21319

Approved for public release; distribution is unlimited.

Title: Impact of Detonations. Comparison of Conventional and Nuclear Explosive Detonations.

Author(s): Toevs, James Waldo
Abhold, Mark

Intended for: Report

Issued: 2018-02-21

Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.



Impact of Detonations

Comparison of conventional and
nuclear explosive detonations

James Toevs, Mark Abhold

February 2018 | Los Alamos National Laboratory

Murrah Federal Building – Oklahoma City



Conventional high explosive – ammonium nitrate fertilizer with some nitromethane and diesel fuel.

2.3 to 4 T (2.3 to 4 tons) TNT equivalent

UNCLASSIFIED

Binhai District of Tianjin, China



First explosion
~3 T (3 tons) TNT equivalent

Second explosion
21 T (21 tons) TNT equivalent

Conventional high explosive – ammonium nitrate, potassium nitrate, and other explosive material.

TNT equivalent yields were determined from seismic shock waves.

UNCLASSIFIED

Binhai District of Tianjin, China



Blast crater for 21 T TNT – compare with Nagasaki 21 kT (21,000 tons) TNT.

UNCLASSIFIED

Binhai District of Tianjin, China

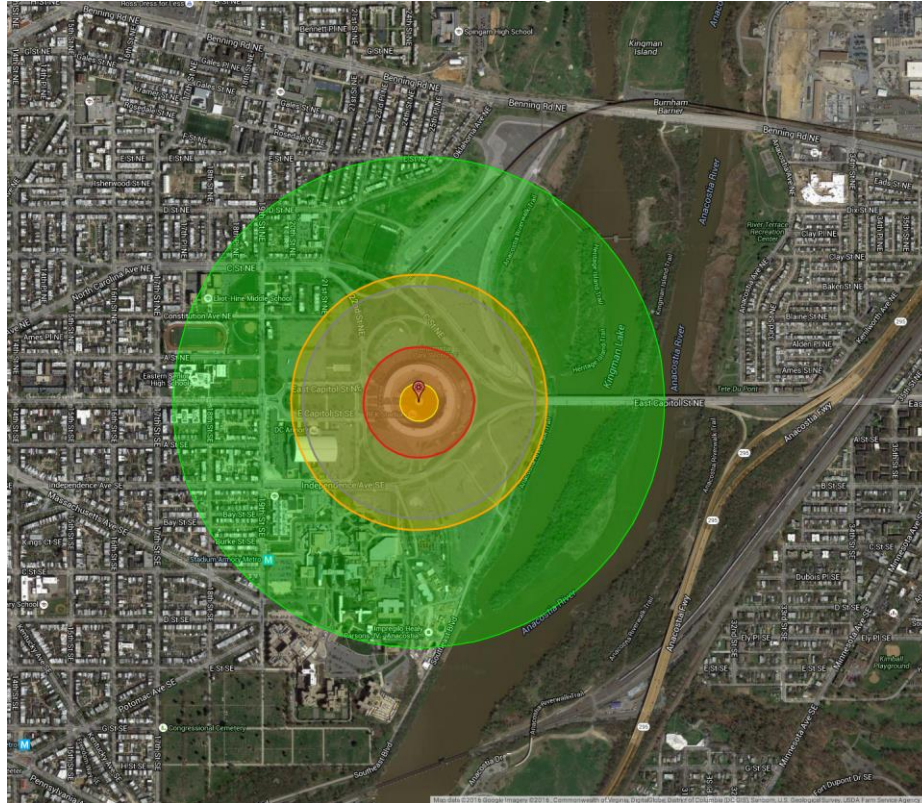


*Blast damage
from 21-T
detonation*



UNCLASSIFIED

400 T nuclear detonation at RFK Stadium



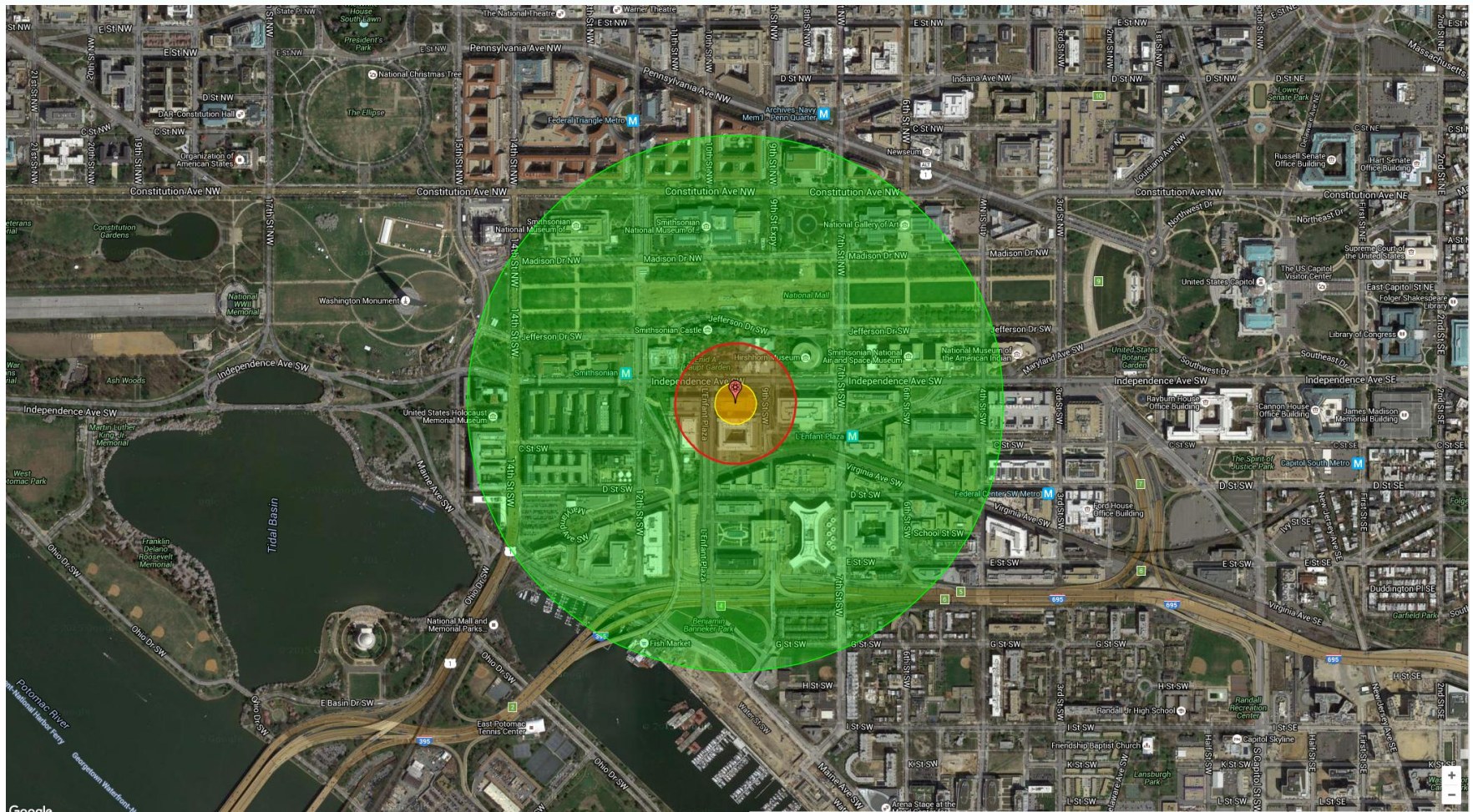
(NUKEMAP model and simulation)

400 T surface burst at RFK stadium – capacity 45,596 all of whom would be within the 20 psi air blast radius (red circle) for which fatalities approach 100%; most would be engulfed by the fireball (orange circle in center).



UNCLASSIFIED

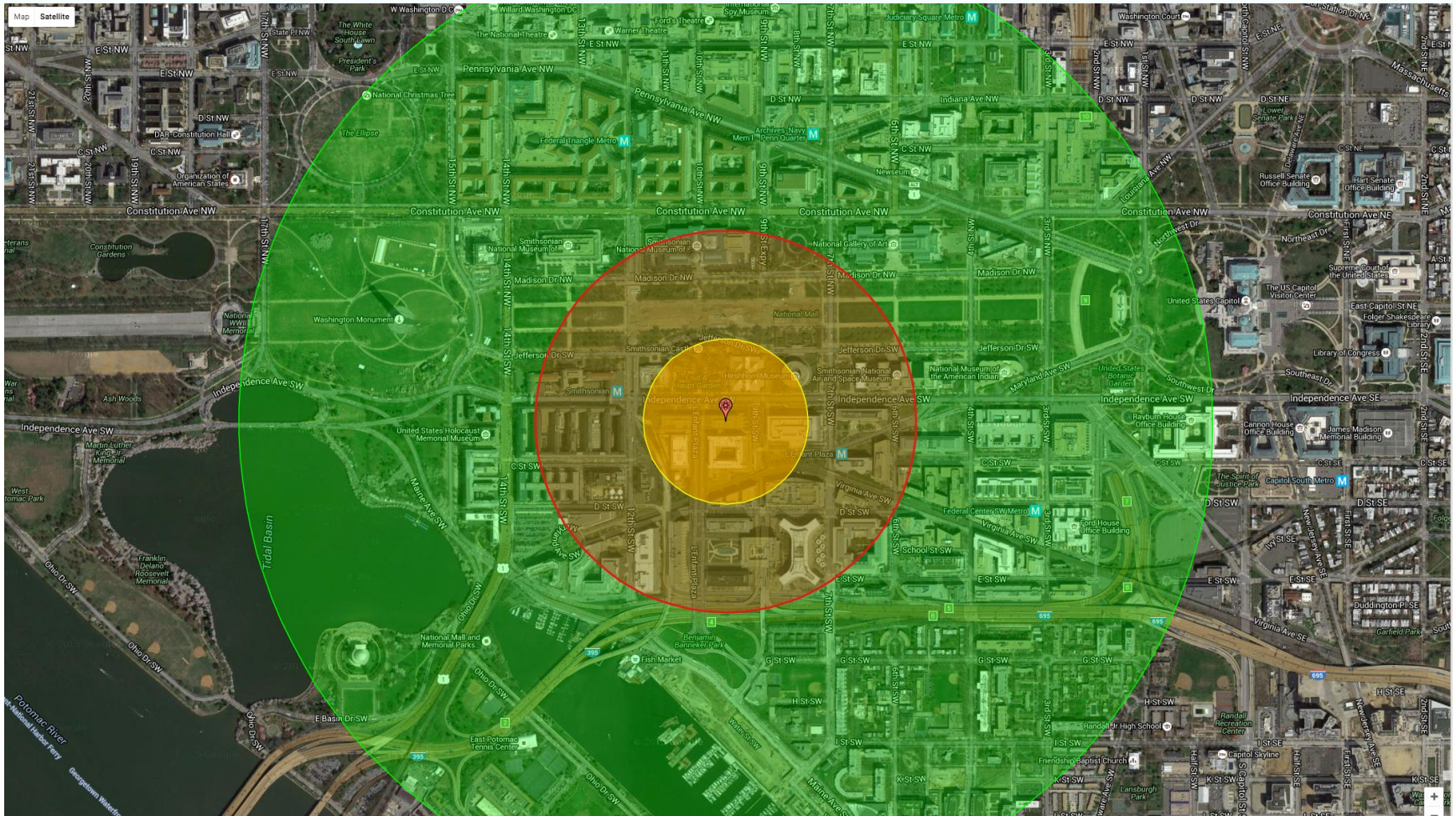
400 T nuclear detonation on Constitution in front of Forrestal Building



Surface burst; people within green circle would receive 500 R radiation dose → 50% - 90% mortality (NUKEMAP model).

UNCLASSIFIED

13 kT (13,000 ton) detonation on Constitution in front of Forrestal Building



Orange circle: fireball. Red circle: 20 psi overpressure. Green circle: 50% - 90% mortality.

UNCLASSIFIED

13 kT (13,000 ton) detonation on Constitution in front of Forrestal Building – additional impact



Fireball 15 seconds after detonation

Injuries from blast and burns, damage to structures and infrastructure – power, bridges, hospitals, transportation – all extend well past the lethality circle indicated in previous slide.

(NUKEMAP model and simulation)



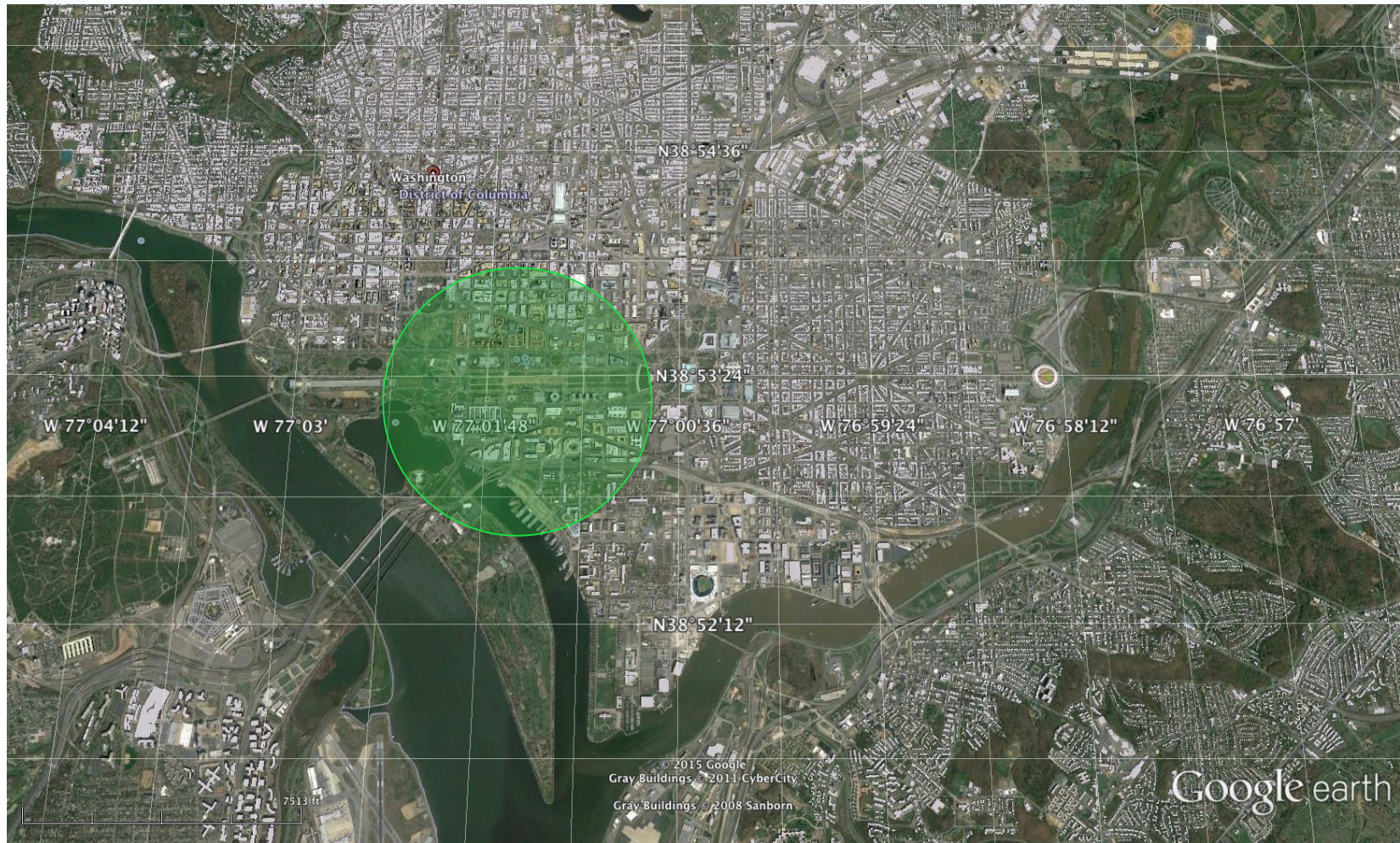
Radioactive fallout extends past Baltimore

Thousands will be exposed to the fallout plume; the 100 R/hour contour extends for ~ 20 miles, 10 R/hour for 43 miles.

10 R/hour is ~ 250,000 times natural background

UNCLASSIFIED

13 kT (13,000 ton) detonation in Washington – pick your target



Centered again at Forrestal; click on green circle to move it to target of choice.

UNCLASSIFIED